

# Oil & Natural Gas Technology

DOE Award No.: DE-FC26-04NT15545

## FINAL TECHNICAL REPORT

PERIOD BEGINNING SEPTEMBER 1, 2004 AND ENDING SEPTEMBER 30, 2007

### Identification, Verification, and Compilation of Produced Water Management Practices for Conventional Oil and Gas Production Operations

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Prepared for:  
United States Department of Energy  
National Energy Technology Laboratory

September 28, 2007



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## **ABSTRACT**

The project is titled "Identification, Verification, and Compilation of Produced Water Management Practices for Conventional Oil and Gas Production Operations." The Interstate Oil and Gas Compact Commission (IOGCC), headquartered in Oklahoma City, Oklahoma, is the principal investigator and the IOGCC has partnered with ALL Consulting, Inc., headquartered in Tulsa, Oklahoma, in this project. State agencies that also have partnered in the project are the Wyoming Oil and Gas Conservation Commission, the Montana Board of Oil and Gas Conservation, the Kansas Oil and Gas Conservation Division, the Oklahoma Oil and Gas Conservation Division and the Alaska Oil and Gas Conservation Commission.

The objective is to characterize produced water quality and management practices for the handling, treating, and disposing of produced water from conventional oil and gas operations throughout the industry nationwide. Water produced from these operations varies greatly in quality and quantity and is often the single largest barrier to the economic viability of wells. The lack of data, coupled with renewed emphasis on domestic oil and gas development, has prompted many experts to speculate that the number of wells drilled over the next 20 years will approach 3 million, or near the number of current wells. This level of exploration and development undoubtedly will draw the attention of environmental communities, focusing their concerns on produced water management based on perceived potential impacts to fresh water resources. Therefore, it is imperative that produced water management practices be performed in a manner that best minimizes environmental impacts.

This is being accomplished by compiling current best management practices for produced water from conventional oil and gas operations and to develop an analysis tool based on a geographic information system (GIS) to assist in the understanding of watershed-issued permits. That would allow management costs to be kept in line with the specific projects and regions, which increases the productive life of wells and increases the ultimate recoverable reserves in the ground.

A case study was conducted in Wyoming to validate the applicability of the GIS analysis tool for watershed evaluations under real world conditions. Results of the partnered research will continue to be shared utilizing proven methods, such as on the IOGCC Web site, preparing hard copies of the results, distribution of documented case studies, and development of reference and handbook components to accompany the interactive internet-based GIS watershed analysis tool. Additionally, there have been several technology transfer seminars and presentations. The goal is to maximize the recovery of our nation's energy reserves and to promote water conservation.

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## **INTRODUCTION**

This is the Final Technical Report for the Department of Energy (DOE) project titled Identification, Verification, and Compilation of Produced Water Management Practices for Conventional Oil and Gas Production Operations submitted by the Interstate Oil and Gas Compact Commission (IOGCC) under DOE Cooperative Agreement No. DE-FC26-04NT15545. This report details progress for the months of September 2004 through September 2007 completed by the IOGCC and ALL Consulting, LLC (ALL) team for the project. This report details the tasks completed, tasks in progress, problems encountered, problems resolved, miscellaneous project activities, and tasks to be conducted over the remainder of the grant.

## **EXECUTIVE SUMMARY**

After the completion of the research phase of this project, the IOGCC has worked to communicate its final product to various audiences. IOGCC identified key audiences as IOGCC member states, federal government, educational institutions, environmental groups, industry trade organizations, and agricultural groups.

Activities to disseminate the results and findings of the research project to target audiences, included congressional testimony, dissemination of the final guidebook, distribution of a brochure and CD-ROM, Web site postings, media coverage, an awareness campaign, and trade show displays.

Technology transfer activities have sparked the interest of the general public, government and industry. Media coverage has included articles in industry and professional journals, national and regional newspapers, and environmental publications.

Final report preparation will involve the measurement and analysis of the results of technology transfer activities. Measurement will incorporate pre- and post-distribution survey data, web site hits, number of documents distributed and other pertinent data.

## **EXPERIMENTAL METHODS**

None

## **RESULTS AND DISCUSSION**

*Tasks Completed.* As previously reported, the research team does not anticipate additional work for Tasks 1.0, 2.0, 3.0, 4.0, 5.0 and 6.0. Therefore, these tasks are considered complete.

A project extension through 09/30/2007 was requested by the project director and granted by the NETL. The purpose of the extension was to allow additional outreach activities in response to interest generated by technology transfer efforts.

*Period Activities.* The final period of the project focused around technology transfer activities to disseminate the results and findings of the research project to target audiences.

After the completion of the research phase of this project, the IOGCC has worked to communicate its final product to various audiences.

### **Key Audiences**

The IOGCC with the cooperation of ALL Consulting developed a thorough communications plan targeting key stakeholders which include:

- IOGCC Member States
  - Governors
  - Representatives
- Federal Government
  - U.S. Congressional Energy and Water Committees
  - U.S. Bureau of Land Management
  - U.S. Department of Energy
- Educational Institutions
- Environmental Groups
- Oil and Gas Industry Associations
- Agricultural Groups

### **Project Promotion/Education Efforts**

#### **Congressional Testimony**

In September 2006, IOGCC Washington Representative Kevin Bliss, testified before the U.S. House of Representatives Subcommittee on Water and Power that water produced as a consequence of oil and natural gas production could be used in areas of the mid-continent and west where prolonged drought has made water a valuable commodity. Bliss cited preliminary findings from this national research effort funded by the U.S. Department of Energy and conducted by the IOGCC and ALL Consulting.

In December the House passed H.R. 5110, the More Water for More Energy Act of 2006. If enacted, the act would facilitate the use of water brought to the Earth's surface as a by-product of oil and natural gas production. In addition, the legislation would allow for grants to develop facilities to increase the amounts of so-called "produced water" suitable for irrigation and other uses.

IOGCC alerted the media about Bliss's testimony and this project through a series of press releases. As a result, the project garnered media coverage in various trade publications, including the *Oil and Gas Journal*, *Congressional Quarterly* and *Petroleum News*.

### **Full Guidebook**

Links to the final report "*Guide to Practical Management of Produced Water from Onshore Oil and Gas Operations in the United States*" were placed on IOGCC's Web site as well as ALL Consulting's Web site. During the period of December to August, the guidebook was downloaded from the IOGCC Web site 1435 times.

Several articles regarding the Guidebook were sent through IOGCC's electronic newsletter with a link to the Guidebook. The newsletter has a distribution of about 555 people.

In addition, a handful of hard copy reports were printed and are available upon request.

### **Brochure/CD-ROM**

A summary brochure was created to highlight the key findings of the IOGCC final report "*Guide to Practical Management of Produced Water from Onshore Oil and Gas Operations in the United States*." The brochure defined produced water, explained the purpose of the project and discussed the tools developed as a result of the project.

The brochure contained a CD-ROM that featured a 20-minute video presentation by Dan Arthur of ALL Consulting, the full final report or "guidebook", and Watershed Analysis Tool.

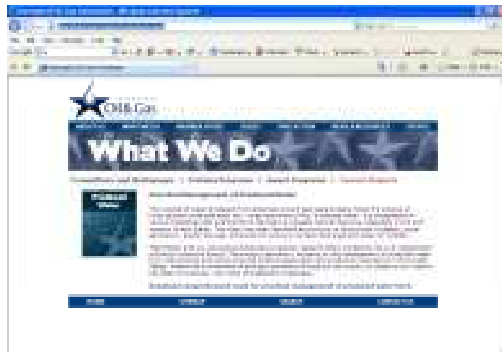
Nearly 4,000 brochures were distributed to state and federal government and industry groups. Industry associations such as OIPA, KIOGA, AAPG, PAWY, MPA and Citizens for Resource Development distributed the brochure at their meetings.

### **Web**

A "current projects" page was added to the IOGCC Web site to feature the produced water project. The page contains an overview of the produced water project and also contained a link to the materials from the CD-ROM that contained the video presentation, full report and Watershed Analysis Tool.

During the period of March to August, the current projects page received 1136 hits, with the section containing materials from the CD-ROM receiving 437 hits.





## Media Coverage

The IOGCC developed a press release and press kit that highlighted the beneficial uses of produced water and the tools developed. The release was distributed to national, state and trade media through the PR Newswire Service on April 10. Phone calls were made, with the help of a local Oklahoma City public relations firm to secure coverage.

[http://www.iogcc.state.ok.us/news\\_PRbody.aspx?PRID=35](http://www.iogcc.state.ok.us/news_PRbody.aspx?PRID=35)

[http://www.iogcc.state.ok.us/news\\_mediakit.aspx](http://www.iogcc.state.ok.us/news_mediakit.aspx)

The purpose of the release was to lead people to the IOGCC Web site.

## Awareness Campaign

A series of advertisements were placed in the following publications and online leading people to produced water tools available on the IOGCC Web site.

- American Oil & Gas Reporter
- Oil and Gas Journal
- Platt's Oilgram News
- Platt's Gas Daily
- Petroleum News
- Casper Star Tribune
- Wyoming Tribune Eagle
- Billings Gazette (Online)
- Geotimes
- WE&T
- Oil Daily
- Platt's (Online)
- Google
- AgWeb

## Trade Show Booth

A trade show booth was developed that partially focuses on tools for managing produced water. Facts from the guidebook were featured on the produced water portion of the booth.

Produced water summary/CD-Roms have already been featured alongside the booth at the IOGCC Annual Meeting. The booth will also be used at the Oklahoma Marginal Well Commission trade show in October.



The IOGCC is in the process of measuring and analyzing the results of technology transfer activities for inclusion in the final report. Measurement will incorporate pre- and post-distribution survey data, web site hits, number of documents distributed and other pertinent data.

## CONCLUSIONS

Although formal analysis is not yet complete, anecdotal evidence shows that technology transfer activities have sparked the interest of the general public, government and industry. Media coverage has included articles in industry and professional journals, national and regional newspapers, and environmental publications. A sampling of articles is attached. Additionally, IOGCC has been asked to present the findings of the report to industry associations and other events.

## **LISTS OF GRAPHICAL MATERIALS**

None

## **REFERENCES**

None

## **BIBLIOGRAPHY**

None

## **LISTS OF ACRONYMS AND ABBREVIATIONS**

AOGCC Alaska Oil and Gas Conservation Commission  
BLM Bureau of Land Management  
DOE Department of Energy  
GIS Geographic Information System  
GWPC Ground Water Protection Council  
IOGCC Interstate Oil and Gas Compact Commission  
MBOGC Montana Board of Oil and Gas Conservation  
NETL National Energy Technology Laboratory  
PAC Project Advisory Committee  
WOGCC Wyoming Oil and Gas Conservation Commission

## **APPENDICES**

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- b. *Gas Daily* (May 14, 2007)
- c. *Oil & Gas Journal* (May 14, 2007)

## **IOGCC NEWS RELEASE**

FOR IMMEDIATE RELEASE - Tuesday, April 10, 2007  
Contact: Erica Carr 405-525-3556 x106, [erica.carr@iogcc.state.ok.us](mailto:erica.carr@iogcc.state.ok.us)

### **Produced water could prove valuable resource to drought-stricken ranchers**

Water is an invaluable resource, but for ranchers like Brett Emmons it's also a matter of survival.

Emmons is among the many ranchers in Montana that have battled a 20-year drought threatening to close down local ranching operations. A self-described rancher/farmer, he struggles to grow his own grain and hay to feed his cattle.

However, help could be just around the corner for Emmons and ranchers and landowners across the country, thanks to a valuable by-product of America's oil and natural gas resources – water.

The volume of water produced from domestic oil and natural gas wells greatly surpasses the amount of oil or gas produced. This traditionally had been problematic for an industry that struggled to find cost-effective water management solutions. However, new technologies and water treatment programs have changed this scenario.

"What has historically been viewed as a waste that was disposed of in a cost-efficient and environmentally sound manner can now be efficiently managed and used as a valuable resource," said Dan Arthur, a partner of Tulsa, Okla., based ALL Consulting.

While some of this "produced water" is too salty for use, large quantities may be utilized as an environmentally safe source of agricultural irrigation, power generation, aquifer storage, enhanced oil recovery, surface discharge and even water for wildlife.

The Interstate Oil and Gas Compact Commission (IOGCC) and ALL Consulting conducted a national research effort, funded by the U.S. Department of Energy's National Energy Technology Laboratory, focusing on the management of produced water from onshore exploration and production operations in the United States.

Researchers evaluated oil and gas operations throughout the country to observe how the industry has dealt innovatively with water management challenges. They released their results in a Guidebook that catalogues produced water quality data and water processing techniques operators are utilizing across the country.

The Guidebook also discusses regulatory challenges associated with produced water.

"It is important that regulatory impediments to the appropriate beneficial use of produced water be removed," said Thomas Richmond, administrator for the Montana Board of Oil and Gas Conservation and a participant in the study. "Water is too important a resource to allow outdated rules to prevent its use or make it unnecessarily costly to use."

Currently, each of the oil and gas producing states remains responsible for regulating produced water in accordance with its specific geographic and geologic conditions.

"The Guidebook will help state and federal regulators develop produced water regulations that are most protective of the environment and that encourage beneficial uses appropriate to the region, without disrupting domestic oil and natural gas production," said Arthur.

For Emmons the resource is a win-win. "Produced water is part of a solution to keep ranching alive in this area," he said. "At the rate it's going now, the small guy is going to go away and not far behind them will be the communities they live in."

To find out more about produced water and its beneficial uses, log on to [www.iogcc.state.ok.us](http://www.iogcc.state.ok.us).

The IOGCC, representing the governors of 30 member and seven associate states, promotes the conservation and efficient recovery of the nation's oil and natural gas resources while protecting health, safety and the environment. Established by the charter member states' governors in 1935, and approved by Congress, it is the oldest, largest and most effective interstate compact in the nation.

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NATIONAL NEWS

OKLAHOMA CITY, April 10 /PRNewswire/ -- Water is an invaluable resource, but for ranchers like Brett Emmons it's also a matter of survival.

(Photo: <http://www.newscom.com/cgi-bin/prnh/20070410/CLTU038> )

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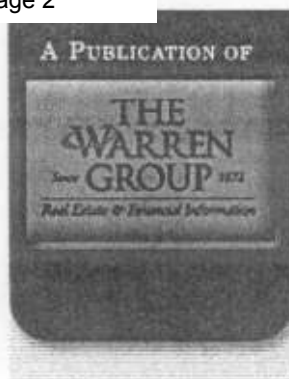
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"The Guidebook will help state and federal regulators develop produced

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News Headlines from:



## Environmental Services News

### Produced Water Could Prove Valuable Resource to Drought-Stricken Ranchers



IOGCC's web site contains practical tools for produced water management. (PRNewsFoto/The Interstate Oil and Gas Compact Commission)

OKLAHOMA CITY, OK, UNITED STATES 04/10/2007

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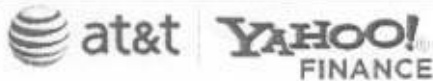
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Press Release

Source: The Interstate Oil and Gas Compact Commission

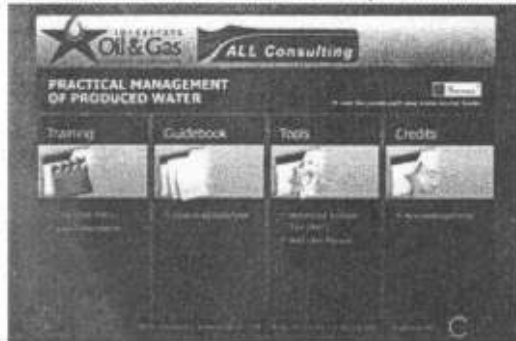
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Tuesday April 10, 8:30 am ET

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(Photo: <http://www.newscom.com/cgi-bin/prnh/20070410/CLTU038> )

Source: The Interstate Oil and Gas Compact Commission



- IOGCC's web site contains practical tools.
- [Click Here to Download Image](#)

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Source: The Interstate Oil and Gas Compact Commission

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## Produced Water Could Prove Valuable Resource to Drought-Stricken Ranchers

Apr 10 04:30 AM US/Eastern



PR Newswire  
United Business Media

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SOURCE The Interstate Oil and Gas Compact Commission

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Produced Water Could Prove Valuable Resource To Drought-Stricken Ranchers

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SOURCE The Interstate Oil and Gas Compact Commission

Erica Carr of Interstate Oil and Gas Compact Commission, +1-405-525-3556  
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Posted on : 2007-04-10 | Author : The Interstate Oil and Gas Compact Commission  
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**SOURCE** The Interstate Oil and Gas Compact Commission

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IOGCC's web site contains practical tools for produced water management (PRNewsFoto/The Interstate Oil and Gas Compact Commission)

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To find out more about produced water and its beneficial uses, log on to <http://www.iogcc.state.ok.us/>.

The IOGCC, representing the governors of 30 member and seven associate states, promotes the conservation and efficient recovery of the nation's oil and natural gas resources while protecting health, safety and the environment. Established by the charter member states' governors in 1935, and approved by Congress, it is the oldest, largest and most effective **interstate compact** in the nation.

CONTACT: Erica Carr of **Interstate Oil and Gas Compact Commission**, +1-405-525-3556 x 106; or Cyndy Hoenig for **Interstate Oil and Gas Compact Commission**, +1-405-285-7575

Web site: <http://www.iogcc.state.ok.us/>

SOURCE The **Interstate Oil and Gas Compact Commission**

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Appendix1(k)

page 3

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SOURCE The Interstate Oil and Gas Compact Commission

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**Produced Water Could Prove Valuable Resource to Drought-Stricken Ranchers**  

OKLAHOMA CITY, April 10 /PRNewswire/ -- Water is an invaluable resource, but for ranchers like Brett Emmons it's also a matter of survival.

(Photo: <http://www.newscom.com/cgi-bin/prnh/20070410/CLTU038>)

Emmons is among the many ranchers in Montana that have battled a 20-year drought threatening to close down local ranching operations. A self-described rancher/farmer, he struggles to grow his own grain and hay to feed his cattle.

However, help could be just around the corner for Emmons and ranchers and landowners across the country, thanks to a valuable by-product of America's oil and natural gas resources -- water.

The volume of water produced from domestic oil and natural gas wells greatly surpasses the amount of oil or gas produced. This traditionally had been problematic for an industry that struggled to find cost-effective water management solutions. However, new technologies and water treatment programs have changed this scenario.

"What has historically been viewed as a waste that was disposed of in a cost-efficient and environmentally sound manner can now be efficiently managed and used as a valuable resource," said Dan Arthur, a partner of Tulsa, Okla., based ALL Consulting.

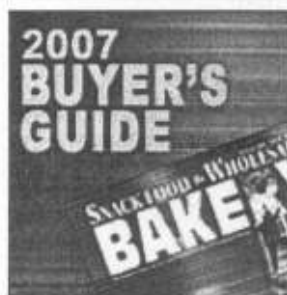
While some of this "produced water" is too salty for use, large quantities may be utilized as an environmentally safe source of agricultural irrigation, power generation, aquifer storage, enhanced oil

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recovery, surface discharge and even water for wildlife.

The Interstate Oil and Gas Compact Commission (IOGCC) and ALL Consulting conducted a national research effort, funded by the U.S. Department of Energy's National Energy Technology Laboratory, focusing on the management of produced water from onshore exploration and production operations in the United States.

Researchers evaluated oil and gas operations throughout the country to observe how the industry has dealt innovatively with water management challenges. They released their results in a Guidebook that catalogues produced water quality data and water processing techniques operators are utilizing across the country.

The Guidebook also discusses regulatory challenges associated with produced water.

"It is important that regulatory impediments to the appropriate beneficial use of produced water be removed," said Thomas Richmond, administrator for the Montana Board of Oil and Gas Conservation and a participant in the study. "Water is too important a resource to allow outdated rules to prevent its use or make it unnecessarily costly to use."

Currently, each of the oil and gas producing states remains responsible for regulating produced water in accordance with its specific geographic and geologic conditions.

"The Guidebook will help state and federal regulators develop produced water regulations that are most protective of the environment and that encourage beneficial uses appropriate to the region, without disrupting domestic oil and natural gas production," said Arthur.

For Emmons the resource is a win-win. "Produced water is part of a solution to keep ranching alive in this area," he said. "At the rate it's going now, the small guy is going to go away and not far behind them will be the communities they live in."

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SOURCE The Interstate Oil and Gas Compact Commission

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## News from the Wires

### Produced Water Could Prove Valuable Resource to Drought-Stricken Ranchers

2007-04-10 | 08:30

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While some of this "produced water" is too salty for use, large quantities may be utilized as an environmentally safe source of agricultural irrigation, power generation, aquifer storage, and recovery, surface discharge and even water for wildlife.

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## Developments in the Produced Water Arena

One element of DOE's produced water program focuses on produced water and the many issues associated with it. Several recent developments deserve notice.

**Produced Water Management Information System (PWMIS)** (<http://web.evs.anl.gov/pwmis/>). DOE's National Energy Technology Laboratory, in partnership with Argonne National Laboratory, has developed the web-based PWMIS. The new system offers critical information on current technologies and best practices, summaries of relevant state and Federal regulations and a decision tree for technology options to deal with produced water issues. PWMIS is an easily navigable web tool that consolidates all the required information in one location.

**Desalination Unit.** In a DOE-supported project Texas A&M University has developed a new technology to remove salts and minerals from brackish coproduced water, yielding safe drinking water. The project's mobile desalination unit can process as much as 238 bwpd. It enables one to re-use about 30 percent of a well's wastewater stream, reducing the volume and costs of salt water disposal. The technology has been licensed to GeoPure Water Technologies LLC to commercialize. *View further information in DOE's Techline online at [www.netl.doe.gov/publications/press/2007/070720-Oil\\_and\\_Gas\\_Produced-Water.html](http://www.netl.doe.gov/publications/press/2007/070720-Oil_and_Gas_Produced-Water.html).*

**Guide to Management of Produced Water.** The Interstate Oil & Gas Compact Commission (IOGCC) in cooperation with ALL Consulting has completed a comprehensive new guidebook to the current best management practices for produced water from conventional gas and oil operations. The guidebook, entitled *A Guide to Practical Management of Produced Water from Onshore Oil & Gas Operations in the United States*, is available through IOGCC's website ([www.iogcc.state.ok.us/projects.aspx](http://www.iogcc.state.ok.us/projects.aspx)). The project also developed an online geographic information system (GIS)-based analysis tool to help producers understand watershed-related regulations and permits and calculate the impacts of produced water in specific areas according to various oil and gas field development scenarios. The online guidebook and GIS tools will help regulatory agencies devise more effective regulations to make water management easier while still maintaining environmental protection. ♦

## DOE Receives AAPG's Corporate Award for Excellence in Environmental Stewardship

The American Association of Petroleum Geologists (AAPG) recently recognized DOE for its work in a network of regional carbon sequestration partnerships by selecting them for their "Corporate Award for Excellence in Environmental Stewardship." Nearly 350 organizations in 41 U.S. states, four Canadian provinces and three Indian nations are involved. A two-year characterization phase identified more than 3,500 billion tons of potential CO<sub>2</sub> storage capacity in geologic formations. The partnerships are currently working to implement 25 geologic sequestration tests.

*View further information in DOE's Techline online at [www.fe.doe.gov/news/techlines/2007/07026-DOE\\_Earns\\_Environmental\\_Award.html](http://www.fe.doe.gov/news/techlines/2007/07026-DOE_Earns_Environmental_Award.html).* ♦

## Closed-Loop Drilling: One Operator's Experience in NM

Drilling pits are an issue in New Mexico. Although perceived as being more costly than traditional pits, that is not necessarily so. Cimarex Energy Co. described their experience using an engineered on-site drilling waste treatment system on nearly 40 wells in Lea and Eddy Counties, New Mexico. Cimarex found that the average cost of using a pit and hauling the waste elsewhere for disposal is about 45% more compared to following the same process without a reserve pit. When burying the waste on-site, costs are about 24% higher when using a reserve pit. Cuttings volumes are significantly less, some 60 to 70% less. To top it off, the footprint of the drilling operation is reduced.

*Excerpted from "Closed-Loop Drilling System: A Viable Alternative to Reserve Waste Pits," World Oil, December 2006, pp. 41-48 available online at [www.worldoil.com/magazine/MAGAZINE\\_DETAIL.asp?ART\\_ID=3053&MONTH\\_YEAR=Dec-2006](http://www.worldoil.com/magazine/MAGAZINE_DETAIL.asp?ART_ID=3053&MONTH_YEAR=Dec-2006).* ♦

## SEQUIRE™ Well Finding Technology

The SEQUIRE well finding technology, developed by NETL researchers in partnership with Apogee Scientific, Inc. (Englewood, Colo.), Fugro Airborne Surveys (Mississauga, Ontario, Canada) and LaSen, Inc. (Las Cruces, N.M.), employs magnetic and methane sensors deployed on helicopters to accurately locate abandoned and leaking wells. Finding these wells is valuable for secondary and tertiary recovery projects, but it is absolutely critical in future CO<sub>2</sub> sequestration projects. SEQUIRE, along with two other technologies developed in DOE-supported R&D projects, received an R&D 100 Award from *R&D Magazine* for 2007.

*For more information, view DOE's TechLine at [www.fe.doe.gov/news/techlines/2007/07058-FE\\_Technologies\\_Win\\_Awards.html](http://www.fe.doe.gov/news/techlines/2007/07058-FE_Technologies_Win_Awards.html).* ♦

## Green Completions in Fort Worth Basin Attractive for Devon

During a May 2007 EPA Natural Gas STAR workshop, Devon Energy Corp. shared their experience with reduced-emission or "green" completion practices in their Fort Worth Basin operations. With conventional practices, a well is flowed back to frac tanks until clean up is completed. Tubing is then snubbed in the hole while venting gas to atmosphere. Gas during required open flow potential tests is also vented to atmosphere. With reduced-emission completions, a temporary flowline and meter run is on location during completion. The well is flowed back to frac tanks until gas is encountered, at which time the well is turned to sales and revenue realized during further cleanup, snubbing and testing. In their Fort Worth Basin operations Devon's incremental costs are about \$6,000 per well—but the incremental revenue from sale of captured gas is more than 10 times that. The work environment is safer and wells can be cleaned up longer. Since starting the practice in March 2004 through 2006, Devon had captured and sold about 3.7 Bcf of natural gas, realizing about \$20 million in profits.

*For more information, view Devon's presentation online at [www.epa.gov/gasstar/workshops/collegestation-may2007/7-completions.pdf](http://www.epa.gov/gasstar/workshops/collegestation-may2007/7-completions.pdf).* ♦

## EPA's Natural Gas STAR Program

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Sep. 11  
Sep. 13  
Oct. 23-24

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Glenwood Springs, CO  
Durango, CO  
Houston, TX

Producer Tech Transfer Meeting  
Producer Tech Transfer Meeting  
Producer Tech Transfer Meeting  
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Appendix 2(b)



04/22/2007

## National study results in guidebook on produced water

Mella McEwen<br>Oil Editor  
Midland Reporter-Telegram

**Water produced in conjunction with oil and natural gas has been a challenge for operators since the nation's first oil well was drilled.**

In fact, the Interstate Oil and Gas Compact Commission (IOGCC) estimates oil and gas operations yield approximately 14 billion gallons of water a year.

Armed with funding from the Department of Energy's National Energy Technology Laboratory, the IOGCC and ALL Consulting of Tulsa conducted a study of how produced water is managed at various producing basins around the nation. Those results have been compiled into a newly released guidebook that catalogues produced water quality and the various processing techniques used around the country.

"That was one of the drivers behind this project," said Bruce Langhus, vice president of geology with ALL. "All through the arid West, there is a need for water. Some produced water is usable, other supplies of produced water need treatment. In Wyoming, there's a lot of water being treated and used. In Oklahoma and West Texas, there's not a lot being done. This guidebook is to help spur more treatment."

Researchers visited 25 states and toured more than 80 production facilities conducting what Langhus called "a broadbrush study throughout all the basins. We looked hard at treatment techniques and uses."

They found water quality varied. For example, the Permian Basin produces huge volumes of water daily but only a small percentage of that water is suitable for irrigation. The Power River Basin in Wyoming and Montana, by contrast, produces modest volumes of water, but most of that water is suitable for irrigation.

Langhus speculated that the cost of treating the produced water is one barrier to its increased use in the Permian Basin, whether for livestock or wildlife, for irrigation or other industrial uses.

About 6 percent of the U.S. Geological Survey's Permian Basin water samples is high-quality water produced from shallow aquifers that don't produce hydrocarbons. The majority of the water samples -- 31 percent -- are low to moderate brine, followed by moderate brine (29 percent) and low to moderate saline (21 percent). The USGS said the high quality water is found along the Permian Basin boundaries and can be used raw or, for some industrial or municipal uses, with some treatment. The remainder of the classification is low to moderate saline water, which is evenly distributed throughout the Permian Basin and is largely used in secondary recovery projects.

Langhus said samples were taken from deep water wells and from water produced in conjunction with oil and gas.

"There could be a number of uses," he said, pointing out that cattle and sheep could thrive on water that is less than high-quality. Some communities are treating the water for their use. Other uses, in addition to irrigation or secondary oil recovery, could include power generation, aquifer storage or surface discharge.

In addition to discussing the various techniques different producing areas use to treat produced water, the guidebook also discusses regulatory challenges involved with produced water.

The full guidebook is being printed and can be requested from the IOGCC in either printed or electronic form by calling (405) 521-1111 or via e-mail at [erica.carr@iogcc.state.ok.us](mailto:erica.carr@iogcc.state.ok.us). Online it is available at [www.iogcc.state.ok.us](http://www.iogcc.state.ok.us).

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A dark, textured rectangular graphic with the text "How should we feed Texas schools?" written in a white, hand-drawn, chalk-like font. The text is arranged in two lines, with "How should we feed" on the top line and "Texas schools?" on the bottom line.

## New IOGCC Report Released



A Guide to Practical Management of Produced Water from On-shore Oil and Gas Operations in the United States was funded by the National Energy Technology Laboratory (NETL) of the U.S. Department of Energy (DOE) program.

The Interstate Oil and Gas Compact Commission (IOGCC) and All Consulting (ALL) conducted this study as co-researchers in cooperation with the oil and gas agencies of Alaska (Alaska Oil and Gas Conservation Commission), Montana (Montana Board of Oil and Gas Conservation), Wyoming (Wyoming Oil and Gas Conservation Commission), Kansas (Kansas Corporation Commission), and Oklahoma (Oklahoma Corporation Commission).

Researchers evaluated oil and gas operations throughout the country to observe how the industry has dealt innovatively with water management challenges. They released their results in this Guidebook that catalogues produced water quality data and water processing techniques operators are utilizing across the country.

The Guidebook also discusses regulatory challenges associated with produced water. Currently, each of the oil and gas producing states remains responsible for regulating produced water in accordance with its specific geographic and geologic conditions.

The effort was overseen by NETL's, National Petroleum Technology Office in Tulsa, Oklahoma. The National Petroleum Technology Office project manager for this effort was Mr. John Ford, a active participant of the Marginal Well Commission's Operator's Roundtables.

IOGCC's website ([www.iogcc.state.ok.us](http://www.iogcc.state.ok.us)) has an in-depth presentation discussing the practical management of produced water, including a video presentation, the guidebook and watershed analysis tool.

## Legislative Update

House Bill 1696 gives the Oklahoma Bureau of Investigation (OSBI) extra power to work theft of oil field equipment, which is a multi-million dollar problem in the State of Oklahoma. House Bill 1696 was authored by Danny Morgan of the House and Harry Coates of the Senate, and given to the governor for signature.

Power and duty has been given to the OSBI to stop any vehicle transporting or appearing to transport any oil, gas, salt water or oil field equipment, for the purpose of inspecting, measuring, and taking sample of the cargo and inspecting load tickets to ensure that such vehicle is not transporting unlawful gas, unlawful oil, or stolen oil field equipment.

Also each agent of the OSBI, FBI, highway patrol, and sheriffs departments in the State of Oklahoma have been given authorization to stop any vehicle transporting or appearing to transport oil, gas, salt water or oil field equipment, for the purpose of inspecting, measuring, and taking samples of the cargo and inspecting the load ticket of such vehicle to ensure that the cargo conforms to such load ticket. Except in specific instances upon stopping any vehicle pursuant to this section, such patrolmen, agents, or sheriffs are not authorized to take any samples of the cargo of such vehicle until the vehicle arrives at its destination as indicated on its load ticket.

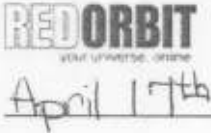
New language has been introduced in the bill giving definitions and explanations to the following terms: pipeline equipment; oil and gas equipment; used materials; dealers; broker, peddler terms.

This act shall become effective as of November 1, 2007, assuming approval of the governor.

Of course the complete text of the HB1696 could not be published in its entirety, but if you would like a copy of the bill you can visit [http://webserver1.lsb.state.ok.us/2007-08bills/HB/HB1696\\_ENGR.RTF](http://webserver1.lsb.state.ok.us/2007-08bills/HB/HB1696_ENGR.RTF) and print it out or you can also contact the Marginal Well Commission headquarters office at (800) 390-0460 and we will mail you a copy of the bill.

The Oklahoma Legislature Website is a great tool. Visit anytime at <http://www.lsb.state.ok.us/>.

Appendix 2(d)



## **OKC-Based Organization Says Water Produced From Oil, Gas Wells Now a Valuable Resource**

By David Page

Historically water produced from oil and gas wells has been considered waste and producers struggled to find cost-effective methods for disposal.

That scenario is changing. New technologies and water treatment programs are converting what was considered waste into a valuable resource.

"Water produced from oil and gas wells that has historically been viewed as a waste that was disposed of in a cost-efficient and environmentally sound manner can now be efficiently managed and used as a valuable resource," said Dan Arthur, managing partner of Tulsa-based All Consulting.

Uses for large quantities of water from drilling operations include agricultural irrigation, power generation, aquifer storage, enhanced oil recovery and water for wildlife. Because of salt levels, not all produced water can be used.

"There are many possibilities to use produced water for ranching and industrial purposes," Arthur said.

The Interstate Oil and Gas Compact Commission, based in Oklahoma City, produced a guidebook, Practical Management of Produced Water, based on national research conducted by the IOGCC and All Consulting. The research was funded by the U.S. Department of Energy's National Energy Technology Laboratory.

Researchers visited 25 states and more than 80 production facilities to conduct the study.

Water produced from oil and gas operations totals 14 billion barrels annually, according to the guidebook. The potential demand is great but people are not accustomed to using water from drilling operations, Arthur said.

"It is certainly a needed commodity," he said.

Wyoming would like to build more power plants but the state does not have a lot of water. Produced water is a possible solution, Arthur said.

Transportation can be a problem but most of the produced water is being used locally. The state of Wyoming has conducted a study on moving produced water long distances.

Houston-based Anadarko Petroleum built a 50-mile pipeline in the Powder River Basin in Wyoming for produced water, Arthur said.

All Consulting was started in 1999 as an environmental and technology consulting company.

# FOCUS Energy

## Water produced from oil and gas wells now a valuable resource

BY DAVID PAGE  
THE JOURNAL RECORD

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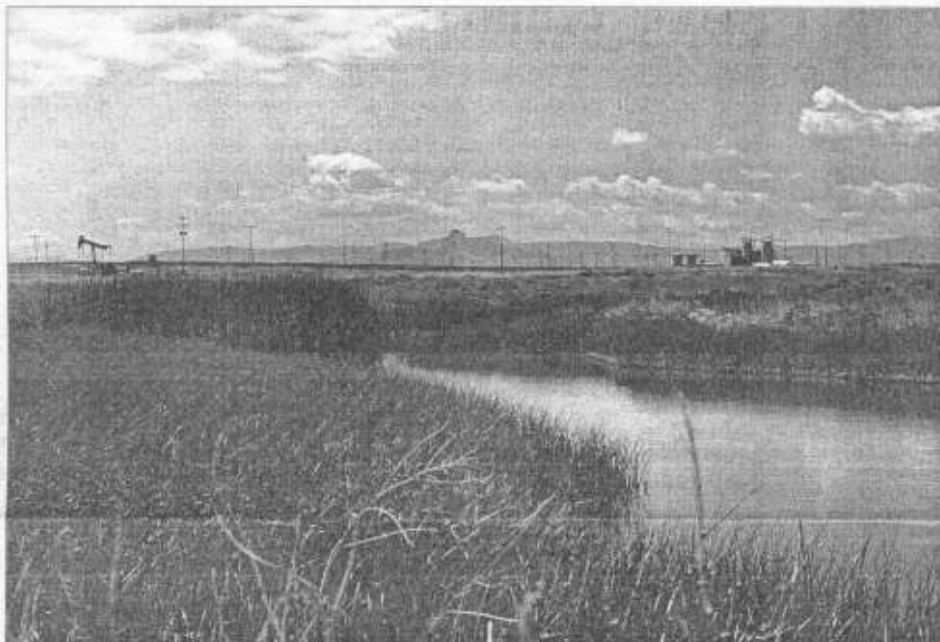
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The produced water that fills this watering hole in the Big Horn Basin of Wyoming provides habitat for waterfowl as well as a source of water for livestock and irrigation.

AP PHOTO

Arthur said.

All Consulting was started in 1999 as an environmental and technology consulting company. Arthur, a petroleum engineer and graduate of the University of Missouri-Rolla, is one of five partners.

"I am a petroleum engineer who has chosen to take an environmental career path," he said.

All Consulting's clients include the U.S. Department of Energy and the U.S. Bureau of Land Management. The company has 35 employees.

"We also work for industry helping them solve environmental problems," Arthur said.

Last week Arthur was in Montana, where ranchers have been battling drought conditions.

Brett Emmons, a Montana farmer and

rancher, has struggled to grow grain and hay to feed his cattle.

"Produced water is part of a solution to keep ranching alive in this area," Emmons said. "At the rate it's going now, the small guy is going to go away, and not far behind them will be the communities they live in."

Oil-bearing basins contain different amounts of water. The guidebook catalogs produced-water quality data and water-processing techniques.

The Permian Basin of Texas and New Mexico produces large volumes of water daily, but only a small percentage is suitable for irrigation. The Powder River Basin produces only moderate volumes of water, but most of the water is suitable for irrigation, according to the IOGCC.

The guidebook, available at [www.iogcc.state.ok.us](http://www.iogcc.state.ok.us), also includes infor-

mation about regulatory challenges.

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"The guidebook will help state and federal regulators develop produced water regulations that are most protective of the environment and that encourage beneficial uses appropriate to the region, without disrupting domestic oil and natural gas production," said Arthur.

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## KIOGA Offers Exciting New Business Development & Marketing Opportunities

KIOGA launched our program earlier this year to provide opportunities for service and supply companies. A vast majority of KIOGA's membership consist of exploration and production companies. Recognizing the tremendous marketing opportunities, many service and supply companies have joined KIOGA. KIOGA is excited to initiate a program that will provide service and supply companies with new opportunities to increase visibility and encourage KIOGA members to do business with fellow KIOGA members. **Texon, L.P.** and **Pratt Well Service, Inc. Environmental Division** have taken advantage of the marketing opportunities by sponsoring the SPCC workshops and soil remediation workshop KIOGA organized around the state. Sponsorship allows companies to increase their visibility with Kansas oil and gas producers and provides a unique value-added marketing opportunity. Please contact KIOGA at 316-263-7297 if you or your company would like more information on how you too can take advantage of this unique marketing opportunity!

KIOGA members told us you need practical information to help you grow your businesses. **Your KIOGA team listened!** Seminars and workshops are a major component in KIOGA's effort to build membership legacy value. KIOGA initiated an industry training and education initiative in 2004 to address the business development needs of the Kansas oil and gas industry. The initiative provides industry training and education needs for regulatory compliance, internal needs, and best management practices. The initiative has reached 1,057 participants from 25 workshops in 7 locations around Kansas in the last 3 years.

At the request of several members, KIOGA is currently organizing Spill Prevention, Control and Countermeasure (SPCC) workshops, remediation of oil and brine spills workshops, and a workshop on the practical management of produced water. By conducting multiple seminars and workshops around the state, KIOGA keeps in touch with our members and develops a better understanding of our member's needs and problems.

### SPCC Workshop

The SPCC workshops focus on the fundamentals for developing an SPCC Plan for your facility that complies with U.S. Environmental Protection Agency (EPA) SPCC

requirements. The half-day workshop is designed to help oil and gas operators develop and/or update their SPCC Plans. Participants receive a model SPCC Plan, quick reference guidelines, and a review of new SPCC requirements being considered by EPA. Thanks to the generous contributions of **Texon, L.P.**, the workshops and breakfast are complimentary. The first SPCC workshop was held in Chanute on March 22<sup>nd</sup> where 30 participants attended. The second SPCC workshop was held in Garden City on April 19<sup>th</sup> where 43 participants attended. The next SPCC workshop will be held in **Hays** at the **Hays Holiday Inn Convention Center, Room Cody A** on **June 28<sup>th</sup> from 7:30 a.m. to noon**. A complimentary breakfast will be served from 7:30 a.m. to 8:30 a.m. Additional SPCC workshops will be held in **Wichita** during the KIOGA Annual Convention in August and in **Pratt** during the fall.

### Remediation of Oil & Brine Spills Workshop

Workshop attendees will learn how to cost effectively remediate oil and brine spills themselves. In addition, attendees will learn how to evaluate vendor claims for hydrocarbon and salt remediation products. The workshop is geared toward oil and gas producers. Attendees will receive workbooks, quick reference guidelines, and soil/water kits for analysis of chlorides. Thanks to the generous contributions of **Pratt Well Service, Inc. Environmental Division**, the workshop and lunch are complimentary. The workshop will be held at the **Best Western Airport Inn & Conference Center** at **6815 W. Kellogg** in **Wichita** on **July 19<sup>th</sup> from 10:30 a.m. to 3:00 p.m.** with a **free lunch**. Please register by July 16<sup>th</sup> by contacting the KIOGA Wichita Office at 316-263-7297.

### Practical Management of Produced Water Workshop

Workshop is designed to provide recommendations that may prove useful for oil and gas operators seeking to maintain economic production from older fields that have progressed to higher water-to-oil ratios. Furthermore, the workshop also provides operators with valuable insights to pursue unconventional oil and gas plays such as coal bed natural gas that can involve high rates of initial water production. The

continued on page 16

## Business Development(continued from page 15)

# FERC Reviewing Natural Gas Quality and Interchangeability Standards

Interstate Oil & Gas Compact Commission (IOGCC) and ALL Consulting created a guidebook that catalogs produced water quality data and water processing techniques to encourage innovative produced water solutions. Treated and untreated produced water may be able to satisfy a great deal of the water needs of ranchers, power plants, and coal mines. The workshop addresses operational parameters, water management strategies, treatment technologies, and water reduction techniques to form practical water management practices. The workshop will be held in **Wichita** and set for August. Watch for notices on our website for the date. Please contact KIOGA at 316-263-7297 if you or your company would like to take advantage of this unique marketing opportunity by sponsoring this workshop.

Don't miss out! Pick a location near you and take advantage of these unique business development opportunities!

The Federal Energy Regulatory Commission (FERC) is entertaining policy discussions concerning curtailment of gas streams into interstate transmission systems in the name of gas quality and interchangeability. For example, placing a Btu limit on natural gas delivered into an interstate transmission system.

KIOGA, along several other oil and gas associations, recently addressed FERC regarding issues of natural gas quality and interchangeability with comments designed to provide a foundation for future policy discussions. The comments were submitted by the Independent Petroleum Association of America (IPAA) on behalf of cooperating oil and gas associations who expressed the desire to be included in the comments. The comments focused on the need to maximize natural gas supply in order to minimize the tightness of natural gas markets. The comments urged FERC to adopt tariff language requiring interstate pipelines to exempt small gas streams from interstate transmission system gas quality specifications. A transcript of the IPAA comments can be obtained by calling the KIOGA Wichita office at 316-263-7297. The Kansas Corporation Commission (KCC) too is filing comments.



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## Produced water could be valuable resource

Water is an invaluable resource, but for ranchers like Brett Emmons it's also a matter of survival.

Emmons is among the many ranchers in Montana that have battled a 20-year drought threatening to close down local ranching operations. A self-described rancher/farmer, he struggles to grow his own grain and hay to feed his cattle.

However, help could be just around the corner for Emmons and ranchers and landowners across the country, thanks to a valuable by-product of America's oil and natural gas resources – water.

The volume of water produced from domestic oil and natural gas wells greatly surpasses the amount of oil or gas produced. This traditionally had been problematic for an industry that struggled to find cost-effective water management solutions. However, new technologies and water treatment programs have changed this scenario.

"What has historically been viewed as a waste that was disposed of in a cost-efficient and environmentally sound manner can now be efficiently managed and used as a valuable resource," said Dan Arthur, a partner of Tulsa-based ALL Consulting.

While some of this "produced water" is too salty for use, large quantities may be utilized as an environmentally safe source of agricultural irrigation, power generation, aquifer storage, enhanced oil recovery, surface discharge and even water for wildlife.

The Interstate Oil and Gas Compact Commission (IOGCC) and ALL Consulting conducted a national research effort, funded by the U.S. Department of Energy's National Energy Technology Laboratory, focusing on the management of produced water from on-shore exploration and production operations in the United States.

Researchers evaluated oil and gas operations throughout the country to observe how the industry has dealt innovatively with water management challenges. They released their results in a Guidebook that catalogues produced water quality data and water processing techniques operators are utilizing across the country.

Currently, each of the oil and gas pro-

ducing states remains responsible for regulating produced water in accordance with its specific geographic and geologic conditions.

"The Guidebook will help state and federal regulators develop produced water regulations that are most protective

of the environment and that encourage beneficial uses appropriate to the region, without disrupting domestic oil and natural gas production," said Arthur.

To find out more about produced water and its beneficial uses, log on to [www.iogcc.state.ok.us](http://www.iogcc.state.ok.us).



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procompetitive. The FTC's decision demonstrates a fundamental and troubling lack of understanding about the areas in which Western Refining and Giant operate, the competitors in those areas, and the competitive nature of those areas," said Paul L. Foster, Western's president and chief executive officer.

Fred L. Hollinger, Giant's chairman and chief executive officer, noted that the two companies represent less than 1.5% of the nation's total refining capacity, and that FTC has approved mergers and acquisitions in the past several years that have created much larger refining companies. "The employees of

both companies have spent countless hours preparing documents in response to the FTC's information requests, and we and our advisors haven't seen anything that we believe would serve as a basis for the FTC to oppose this merger," he said.

The companies said FTC has never suggested the need for divestitures or other potential remedies, and that numerous state and trade association officials submitted letters supporting the merger. They note that the companies are small, independent refiners; that the areas in which they operate are highly competitive and have numerous fuel

supply options; that Western has one of the industry's best operations and its expertise would help ensure more reliable gasoline and diesel supplies by improving utilization rates and reducing the risk of unplanned refinery shutdowns; and that the combination would create a more stable organization.

FTC said the proposed merger, which was announced on Nov. 13, 2006, violates Section 5 of the FTC Act and Section 7 of the Clayton Act, as amended. It said it plans to appoint a New Mexico assistant attorney general as a special deputy to the commission to participate in the court action. ♦

## US EPA establishes RFS program requirements

Nick Snow  
Washington Correspondent

The US government announced a requirement for refiners, blenders, and importers to increasingly use renewable fuels from 2007 through 2012. Officials portrayed the renewable fuels standard (RFS), which was authorized under the 2005 Energy Policy Act (EPACT), as an important step toward meeting US President George W. Bush's goal of reducing domestic gasoline use by 20% within 10 years.

US Environmental Protection Agency Administrator Stephen L. Johnson, US Department of Energy Sec. Samuel W. Bodman, and National Highway Traffic Safety Administration Chief Nicole R. Nason told reporters that the RFS would

help domestic renewable and alternative transportation fuel use climb to 35 billion gal/year by 2017.

For 2007, the RFS establishes a renewable fuel share of 4.02%, or roughly 4.7 billion gal, of the total motor fuel consumed in the US. By 2012, the equivalent of at least 7.5 billion gal will be required as part of the US motor fuel mix.

Officials said that the program will promote the use of ethanol, biodiesel, and other petroleum alternatives, as it establishes special incentives to produce and use motor fuels produced from switch grass, wood chips, and other cellulosic biomass. It also will use a trading system to give fuel producers flexibility in using the most economical alternatives, they added.

An RFS standard is only the first step, according to Nason. "We must also continue to improve the efficiency of our passenger cars and light trucks. As part of the president's '20-in-10' energy security plan, we need Congress to give the secretary of transportation authority to reform the current passenger car fuel economy standard," she said.

Charles T. Drevna, vice-president of the National Petrochemical & Refiners Association, said EPA has issued a reasonable framework to implement EPACT's renewable fuel provisions. "NPRA believes that the RFS credit program—the core of the program—must be understandable, allow unambiguous enforcement, and promote adequate flexibility for refiners and gasoline importers," he said. ♦

## IOGCC issues guidebook of produced water data, research

Nick Snow  
Washington Correspondent

The Interstate Oil & Gas Compact Commission has issued a guidebook cataloging produced water data and water processing techniques used by oil and gas operators across the US.

The guidebook contains results of research funded by the US Department of Energy's National Energy Technology Laboratory and conducted by IOGCC and ALL Consulting. Researchers visited more than 80 production facilities in 25 states with regulators and operators as part of the study.

"What has historically been viewed as a waste that was efficiently disposed of in a cost-efficient and environmentally sound manner can now be efficiently managed and used as a valuable resource," said Dan Arthur, a partner in the Tulsa consulting firm.

IOGCC noted that US oil fields



## Price-gouging salvos begin

### GENERAL INTEREST

## Shell to pay \$353 million in reserves settlement

Royal Dutch Shell PLC agreed to pay \$352.6 million, plus administrative costs, to investors outside the US in a settlement related to a series of reserves write-downs. Shell admitted no wrongdoing in the settlement. Investors had said the oil and gas major was involved in improper accounting for oil and gas reserves during 1997-2003.

The company reclassified reserves five times in a little over a year (OGJ Online, Feb. 4, 2005).

In an Apr. 11 news release, Shell said it agreed to settle with a group of European and other investors outside the US. Parties to the settlement include institutional investors including Dutch pension funds led by Stichting Pensiofondso ABP. Others are organizations

The guidebook also organizes water quality data in a geo-spatial framework "alongside average rainfall, evapo-transpiration, and population density" to

identify US areas where water stewardship is important and beneficial use of produced water is vital. Lastly, the guidebook can help edu-

representing individual shareholders in the Netherlands and the Shell Reserves Compensation Foundation, a settlement foundation.

The agreement depends on the Amsterdam Court of Appeals declaring the settlement binding for all of the shareholders that it covers and is subject to agreed opt-out provisions. Regarding US investors, Shell intends to offer a proportional settlement to them, pending approval from the US court overseeing the case.

A legal director for Shell told reporters at a news conference in London that the firm plans to offer US investors an \$80 million settlement.

In addition, Shell is asking the US Securities and Exchange Commission

cate landowners near oil and gas fields, concerned consumers, and environmental groups about the issue, IOGCC said. ♦

to distribute to shareholders the \$120 million that Shell paid in 2004 under a consent agreement resolving the SEC's investigation into Shell's reserves recategorization.

Grant & Eisenhofer PA attorney Jay Eisenhofer said it was an unprecedented settlement of a large-scale European shareholder dispute. His law firm represented the investor group and the special purpose foundation. Grant & Eisenhofer is based in Wilmington, Del., and New York.

"The scale of recovery and the sheer collective unity of the investor group are both unique in a European context," Eisenhofer said, noting that the shareholder class involved a broad swath of

produced 20-50 times more water than crude, which traditionally has been a problem for the industry. Currently, each of the oil and gas producing states making up IOGCC's membership are responsible for regulating produced water in accordance with its specific geology and geography.

US oil and gas operations produce 14 billion bbl/year of water, according to IOGCC. It pointed out that the Permian basin of Texas and New Mexico produces huge volumes, with only a small percentage suitable for irrigation. The Powder River basin in Wyoming and Montana produces only modest volumes, but most of this can be used for irrigation, it said.

### Guidebook's features

Arthur said the guidebook will help state and federal authorities develop produced water regulations, which will encourage beneficial uses while protecting each region's environment. Oil and gas producers also can use it to plan produced water stewardship as they move into new areas, IOGCC said.

Technology transfer recommendations in the guidebook also may prove useful as operators try to maintain economic production from older fields that have progressed to higher water-to-oil ratios, it added. IOGCC said the guidebook also will provide operators a valuable reference as they pursue unconventional resource plays such as the Barnett shale or coalbed methane, which can involve unusually high initial water production rates.

The guidebook assembles operational parameters of produced water management strategies, leading edge water treatment technologies, and water reduction techniques into a catalogue of currently available practices. Many of these already are being used while others require more field trials, according to IOGCC.

Water quality data from many important US onshore oil and gas basins also are listed, with case studies providing examples of water stewardship successes and specific lessons to be learned



Arthur, a petroleum engineer and graduate of the University of Missouri-Rolla, is one of five partners.

"I am a petroleum engineer who has chosen to take an environmental career path," he said.

All Consulting's clients include the U.S. Department of Energy and the U.S. Bureau of Land Management. The company has 35 employees.

"We also work for industry helping them solve environmental problems," Arthur said.

Last week Arthur was in Montana, where ranchers have been battling drought conditions.

Brett Emmons, a Montana farmer and rancher, has struggled to grow grain and hay to feed his cattle.

"Produced water is part of a solution to keep ranching alive in this area," Emmons said. "At the rate it's going now, the small guy is going to go away, and not far behind them will be the communities they live in."

Oil-bearing basins contain different amounts of water. The guidebook catalogs produced-water quality data and water-processing techniques.

The Permian Basin of Texas and New Mexico produces large volumes of water daily, but only a small percentage is suitable for irrigation. The Powder River Basin produces only moderate volumes of water, but most of the water is suitable for irrigation, according to the IOGCC.

The guidebook, available at [www.logcc.state.ok.us](http://www.logcc.state.ok.us), also includes information about regulatory challenges.

"It is important that regulatory impediments to the appropriate beneficial use of produced water be removed," said Thomas Richmond, administrator for the Montana Board of Oil and Gas Conservation and a participant in the study. "Water is too important a resource to allow outdated rules to prevent its use or make it unnecessarily costly to use."

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"The guidebook will help state and federal regulators develop produced water regulations that are most protective of the environment and that encourage beneficial uses appropriate to the region, without disrupting domestic oil and natural gas production," said Arthur.

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Story from REDORBIT NEWS:  
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Published: 2007/04/17 15:00:23 CDT

# Watery waste



PROVIDED BY INTERSTATE OIL AND GAS COMPACT COMMISSION

Water produced along with natural gas from wells in Wyoming's Big Horn Basin fills Custer Lake and provides a habitat for waterfowl and a source of water for livestock and irrigation. The lake is an example of the effort regulators and industry groups are making to use produced water in more economical and environmentally

# Finding uses for drilling byproduct

By Adam Wilmoth  
Business Writer

One of the most costly byproducts of oil and natural gas production could soon become a boon for industry, agriculture and human consumption if research recently conducted by Tulsa engineering firm ALL Consulting proves profitable.

The troublesome waste product in question: water.

Oil and natural gas wells typically produce five to 10 times more water than fuel. New, nonconventional drilling efforts such as coalbed methane and shale production generally release far more water per barrel of usable production. The country's oil and gas wells produce about 14 billion barrels of water annually, according to a study released this week by the Oklahoma City-based Interstate Oil and Gas Compact Commission, the U.S. Department of Energy and Tulsa-based ALL Consulting.

"We're hoping this is going to be the first step to move state regulators to look at produced water as something that is a product rather than a waste," said Christine Hansen, executive director of the compact commission. "Water is an increasingly important commodity, especially in the western states."

Much of the production water contains high levels of salt or other chemicals that prevent it from being used directly as a drinking or irrigation supply. But ALL's research found many areas — including much of Wyoming and even parts of Oklahoma — produce water clean enough for traditional uses.

"We have a lot of drilling activity spawned by higher oil and gas prices in areas where there have been extended droughts and where there has not been enough water for a long time," said Dan Arthur, an ALL managing partner. "Now there is more of a trend towards sustainable development. Operators and regulators are looking for elegant environmental solutions — things that are sustainable, more positive to the operation and cause less of a problem to the public."

Much of the produced water in Oklahoma contains high levels of salt. Even still, the industry in the state uses some of the cleanest produced water for irrigation, stock watering and wildlife watering. Oklahoma also generates less dirty water per well than many other states because state regulators were among the first in the country to approve the use of equipment that is installed at the bottom of a well and separates oil from water before it is pumped out of the ground.

Even dirty water could be used economically, Arthur said.

Water that is free of harmful chemicals, but still too salty or otherwise too dirty to drink, could be used for fisheries, lakes and other purposes, he said. In some cases, the water could be pumped to desalinization or

treatment plants to make it usable.

The dirtiest water could be used for generating electricity or other industrial purposes, Arthur said.

"When water comes out of certain, especially deep wells, it can be 100 to 200 degrees when it reaches the surfaces," Arthur said. "Some operators are looking at running that water through microturbines and generating electricity to help run the pumps and other well-site equipment."

Dirty produced water also can be used with coal mining and coal-fired power plant operations, he said.

In other cases, companies simply are trying to reuse the water in oil and gas drilling. Oklahoma City-based Devon Energy Corp. recently sought and received special permission from the Texas Railroad Commission to reuse produced water in its drilling efforts in the Barnett Shale near Fort Worth, Texas.

## Old solutions

Oil and gas companies have been putting produced water to economic use for more than 100 years. In parts of the Appalachian Mountain region, salty water from oil and gas drilling has been spread out over dirt roads for many decades. The water minimizes ice buildup in the winter and dust in the summer.

There are other such exceptions, but the general practice for many decades has been to pump the produced water deep in the ground, well below the water table, where it could cause no environmental damage.

If the economic use of produced water is to increase, Hansen said, oil and gas companies must recognize the financial benefits and regulators must change the rules to accommodate the new practices.

"There are regulatory changes that must be made, but for that to happen, the industry must become interested in taking advantage of the opportunities to produce water," Hansen said. "The state regulators are more likely to change their regulation in reaction to the industry."

Oil and gas producers in Oklahoma also are studying the increased use of produced water, but the technology likely will gain widespread support only when it is economical, said Mike Terry, executive director of the Oklahoma Independent Petroleum Association.

"I know the challenge is there, but the problem has been trying to do it economically," Terry said. "I think we're getting very close." A cost-effective use of produced water could lead to increased oil and gas production in the state, he said.

"It is expensive to dispose of produced water," he said. "If you didn't have to drill disposal wells in deep formations, that could really speed up the economics of a well and make more wells profitable."

Adam Wilmoth: 475-3470, [awilmoth@oklahoman.com](mailto:awilmoth@oklahoman.com)



The Donnel-Kay/Children's Campaign petitions call for distributing the increased severance tax revenues in varying amounts for local government, school construction, the state education fund and miscellaneous legislative proposals.

Later in the month, press accounts say, two Colorado Springs businessmen filed a fifth ballot initiative to repeal the property tax deduction and increase the severance tax rate to 9.0 percent.

All the petitioners point to Wyoming's 11.2 percent severance tax rate and New Mexico's 9.4 percent rate as justification, the reports add.

Once certified by the Colorado Legislative Council, a ballot initiative must receive 76,047 voter signatures to appear on the state's ballot. □

## 'Roadless Rule' Legal Battle Continues With Government Appeal

DENVER—The U.S. government is appealing a U.S. district court ruling that overturned President Bush's

Roadless Area Development Rule of 2005, according to a report from the Colorado Oil & Gas Association.

COGA says in April the Department of Agriculture and the U.S. Forest Service appealed the September 2006 ruling by the U.S. District Court in San Francisco to the U.S. Court of Appeals for the 9th Circuit, also in San Francisco.

Bush's Roadless Area Development Rule replaced the Roadless Area Conservation Rule of 2001, which President Bill Clinton issued shortly before he left office. The Clinton rule prohibited road construction and reconstruction on 58.5 million acres of inventoried roadless areas administered by the Forest Service in 38 states (*The Reporter*, February 2001, pg. 118).

The Clinton rule was never implemented, however, as a series of lawsuits went for and against it. Then the Bush administration issued its Roadless Area Development Rule in May 2005, which allowed governors to petition the secretary of agriculture to develop regulations to manage roadless areas in ways

that met the specific needs of each state (*The Reporter*, June 2005, pg. 23).

Several attorneys general and environmental organizations filed lawsuits against the Bush rule. Those cases were consolidated in San Francisco before U.S. Magistrate Judge Elizabeth Laporte. In September 2006, Laporte overturned the Bush rule and reinstated Clinton's Roadless Area Conservation Rule (*The Reporter*, October 2006, pg. 19). Laporte held that Bush violated the National Environmental Policy Act by failing to perform an environmental analysis on the effect of removing Clinton's roadless protections, and also violated the Endangered Species Act by failing to consult with the U.S. Fish and Wildlife Service or the National Marine Fisheries Service on the potential effects of the Roadless Area Development Rule.

COGA mentions that the state of Wyoming also is pursuing a legal challenge to the Clinton Roadless Rule. In July 2003, U.S. District Judge Clarence A. Brimmer of Wyoming ruled that the Clinton rule violated both the Wilderness Act and NEPA (*The Reporter*, August 2003, pg. 18). That case was dropped after the Bush administration repealed the Clinton Roadless Rule, but has been revived in the wake of Judge Laporte's decision, COGA says. □

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For more information or to request the tools on CD, contact:

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This project was funded by the U.S. Department of Energy's National Energy Technology Laboratory.

ALL Consulting



## Commissioners Derail Drive For WHS Status For Carrizo Plains NM

SACRAMENTO, CA—The push to have the Carrizo Plains National Monument in eastern San Luis Obispo County, Ca., designated as a U.N. World Heritage Site ended in early March when the Wilderness Society, primary sponsors of the proposal, withdrew its support, the California Independent Petroleum Association reports.

The announcement followed a debate before the San Luis Obispo County of Board of Supervisors where the heritage site proponents were hoping to get a vote of support to counteract a resolution of opposition that the Taft City Council had passed, says CIPA Chief Executive Officer John Martini. Opposition by the local ranching community led the board to vote 3-2 against a resolution supporting the designation, he notes. The county board's vote left the proposal without any official local government support.

(May 14 - Gas Daily)

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Russia Power Conference, Moscow, (918) 831-9160, (918) 831-9161 (fax), e-mail: [registration@petrowell.com](mailto:registration@petrowell.com), website: [www.petrowell.com](http://www.petrowell.com). 29-31.

US Oil and Gas Summit, Paris, +44 (0) 1242 599 090, +44 (0) 1242 060 (fax), e-mail: [info@thenergyexchange.co.uk](mailto:info@thenergyexchange.co.uk), website: [www.thenergyexchange.co.uk](http://www.thenergyexchange.co.uk). May 30-June 1.

SPE European Formation Damage Conference, Scheveningen, (972) 952-9393, (972) 952-9435 (fax), e-mail: [spedal@spe.org](mailto:spedal@spe.org), website: [www.spe.org](http://www.spe.org). May 30-June 1.

## JUNE

Society of Petrophysicists and Well Log Analysts (SPWLA) Annual Symposium, Austin, (713) 947-8727, (713) 947-7181 (fax), e-mail: [info@spwla.org](mailto:info@spwla.org), website: [www.spwla.org](http://www.spwla.org). 3-6.

International Caspian Oil & Gas Exhibition & Conference, Baku, +44 (0) 207 596 5033, +44 (0) 207 596 5006 (fax), e-mail: [julia.winnamko@ite-exhibitions.com](mailto:julia.winnamko@ite-exhibitions.com), website: [www.caspianoil-gas.co.uk](http://www.caspianoil-gas.co.uk). 5-8.

International Liquefied Petroleum Gas Congress & Exhibition, Nice, 32 2 566 51 20/32 2 566 91 29 (fax), website: [www.ogclp.com](http://www.ogclp.com). 6-8.

Society of Petroleum Engineers Annual Meeting, Salt Lake City, (713) 651-1639, e-mail: [hkspce@aol.com](mailto:hkspce@aol.com), website: [www.spe.org](http://www.spe.org). 9-12.

PIRA Scenario Planning Conference, London, 212-686-6808, 212-686-6628 (fax), e-mail: [sales@pira.com](mailto:sales@pira.com), website: [www.pira.com](http://www.pira.com). 11.

Asian Petrochemicals & Gas Technology Conference & Exhibition, Kuala Lumpur, +44 (0) 20 7357 8394, e-mail: [Conference@EuroPetro.com](mailto:Conference@EuroPetro.com), website: [www.europetro.com](http://www.europetro.com). 11-12.

Central European Gas Conference, Berlin, +44 (0) 20 8275 5198, +44 (0) 20 8275 5401 (fax), e-mail: [CEGC@lynne-events.com](mailto:CEGC@lynne-events.com), website: [www.thocegc.com](http://www.thocegc.com). 11-13.

ERTC Refining Management and Strategy Conference,

Vienna, 44 1737 365100, +44 1737 365101 (fax), e-mail: [events@gtforum.com](mailto:events@gtforum.com), website: [www.gtforum.com](http://www.gtforum.com). 11-13.

ILTA Annual International Operating Conference & Trade Show, Houston, (202) 842-9200, (202) 326-8660 (fax), e-mail: [info@ilta.org](mailto:info@ilta.org), website: [www.ilta.org](http://www.ilta.org). 11-13.

IPAA Midyear Meeting, Henderson, Nev., (202) 857-4722, (202) 857-4799 (fax), website: [www.ipaa.org/meetings](http://www.ipaa.org/meetings). 11-13.

EAGE/SPE Europe Conference and Exhibition, London, +31 30 6354055, +31 30 6343524 (fax), e-mail:

[enga@eage.org](mailto:enga@eage.org), website: [www.eage.org](http://www.eage.org). 11-14.

PIRA London Energy Conference, London, 212-686-6808, 212-686-6628 (fax), e-mail: [sales@pira.com](mailto:sales@pira.com), website: [www.pira.com](http://www.pira.com). 12.

GO-EXPO Gas and Oil Exposition, Calgary, Alta., (403) 209-3555, (403) 245-8649 (fax), website: [www.petroleumshow.com](http://www.petroleumshow.com). 12-14.

Health and Safety Excellence Conference, Barcelona, +420 257 218 505, +420 257 218 508 (fax), e-mail: [healthandsafety@jacobfleming.com](mailto:healthandsafety@jacobfleming.com), website: [www.jacobfleming.com](http://www.jacobfleming.com). 12-13.

Asian Downstream Technology & Catalyst Conference & Exhibition, Kuala Lumpur, +44 (0) 20 7357 8394, e-mail: [Conference@EuroPetro.com](mailto:Conference@EuroPetro.com), website: [www.europetro.com](http://www.europetro.com). 13-14.

IADC World Drilling Conference, Paris, (713) 292-1945, (713) 292-1946 (fax), e-mail: [info@iadc.org](mailto:info@iadc.org), website: [www.iadc.org](http://www.iadc.org). 13-14.

PIRA Understanding Global Oil Markets Conference, London, 212-686-6808, 212-686-6628 (fax), e-mail: [sales@pira.com](mailto:sales@pira.com), website: [www.pira.com](http://www.pira.com). 13-14.

Asian Oil, Gas & Petrochemical Engineering Exhibition, Kuala Lumpur, +60 3

4041 0311, +60 3 4043 7241 (fax), e-mail: [ogo@pesoilworld.com](mailto:ogo@pesoilworld.com), website: [www.allworldexhibitions.com](http://www.allworldexhibitions.com). 13-15.

GasChem Conference, Port of Spain, +44 20 7903 2444, +44 20 7903 2432 (fax), e-mail: [conferences@crugroup.com](mailto:conferences@crugroup.com), website: [www.britishtulphurevents.com/Gazchem07\\_prog.htm](http://www.britishtulphurevents.com/Gazchem07_prog.htm). 17-20.

Newfoundland Ocean Industries Association Conference, St. John's, Newf., (709) 758-6610, (709) 758-6611 (fax), e-mail: [noia@noianet.com](mailto:noia@noianet.com), website: [www.noianet.com](http://www.noianet.com). 18-22.

Offshore Newfoundland Petroleum Show, St. John's,

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This project was funded by the U.S. Department of Energy's National Energy Technology Laboratory.



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